

Fifth Edition

CHEMISTRY

The Central Science

Theodore L. Brown

University of Illinois

H. Eugene LeMay, Jr.

University of Nevada

Bruce E. Bursten

The Ohio State University



Prentice Hall, Englewood Cliffs, NJ 07632

Best Available Copy

Library of Congress Cataloging-in-Publication Data

Brown, Theodore L.

Chemistry: the central science/Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten.—5th ed.
p. cm.

Includes index.

ISBN 0-13-126202-5

I. Chemistry. I. LeMay, H. Eugene (Harold Eugene), 1940–
II. Bursten, Bruce E. 1954– III. Title.
QD31.2.B78 1991

540—dc20

90-41267
CIP

Acquisitions editor: Dan Joraanstad
Development editor: Robert J. Weiss
Supplements editor: Alison Munoz
Design director: Florence Dara Silverman
Cover and interior design: Judith A. Matz-Coniglio
Page layout: Diane Koromhas
Prepress buyer: Paula Massenaro
Manufacturing buyer: Lori Bulwin
Photo editor: Lorinda Morris-Nantz
Photo researcher: Yvonne Gerin
Cover photo: © Aaron Jones



© 1991, 1988, 1985, 1981, 1977 by Prentice-Hall, Inc.
A Division of Simon & Schuster
Englewood Cliffs, New Jersey 07632

All rights reserved. No part of this book may be
reproduced, in any form or by any means,
without permission in writing from the publisher.

Printed in the United States of America
10 9 8 7 6 5 4

ISBN 0-13-126202-5

Prentice-Hall International (UK) Limited, London
Prentice-Hall of Australia Pty. Limited, Sydney
Prentice-Hall Canada Inc., Toronto
Prentice-Hall Hispanoamericana, S.A., Mexico
Prentice-Hall of India Private Limited, New Delhi
Prentice-Hall of Japan, Inc., Tokyo
Simon & Schuster Asia Pte. Ltd., Singapore
Editora Prentice-Hall do Brasil, Ltda., Rio de Janeiro

Best Available Copy

chelate effect The generally larger formation constants for polydentate ligands as compared with the corresponding monodentate ligands. (Section 25.2)

chelating agent A polydentate ligand that is capable of occupying two or more sites in the coordination sphere. (Section 25.2)

chemical changes Processes in which one or more substances are converted into other substances. (Also called **chemical reactions**.) (Section 1.1)

chemical equation A representation of a chemical reaction using the chemical formulas of the reactants and products; a **balanced chemical equation** contains equal numbers of atoms of each element on both sides of the equation. (Section 3.1)

chemical equilibrium A state of dynamic balance in which the rate of formation of the products of a reaction from the reactants equals the rate of formation of the reactants from the products; at equilibrium, the concentrations of the reactants and products remain constant. (Section 4.2, Chapter 15: Introduction.)

chemical formula A notation that uses atomic symbols with numerical subscripts to convey the relative proportions of atoms of the different elements in a substance. (Section 2.5)

chemical kinetics The area of chemistry concerned with the speeds, or rates, at which chemical reactions occur. (Chapter 14: Introduction)

chemical properties Properties that describe a substance's composition and its reactivity; how the substance reacts, or changes into other substances. (Section 1.1)

chemical reactions Processes in which one or more substances are converted into other substances. (Also called **chemical changes**.) (Section 1.1)

chemical-vapor deposition A method for forming thin films in which a substance is deposited on a surface and then undergoes some form of chemical reaction to form the film. (Section 12.4)

chiral A term describing a molecule or an ion that cannot be superimposed on its mirror image. (Sections 25.4, 27.2)

chlorofluorocarbons Compounds composed entirely of chlorine, fluorine, and carbon. (Section 18.3)

chlorophyll A plant pigment that plays a major role in conversion of solar energy to chemical energy in photosynthesis. (Section 27.1)

cholesteric liquid crystal A crystal formed from flat, disc-shaped molecules that align through a stacking of the molecular discs. (Section 12.1)

clay minerals A class of hydrated aluminosilicates. (Section 23.5)

coagulation A process in which colloidal particles are enlarged; the resultant larger particles can then be separated by filtration or merely by allowing them to settle out of the dispersing medium. (Section 13.6)

coal A naturally occurring solid containing hydrocarbons of high molecular weight as well as compounds containing sulfur, oxygen, and nitrogen. (Section 5.8)

coefficient The number in front of each formula in a balanced chemical equation. (Section 3.1)

coenzyme (cofactor) A substance that is needed along with some enzyme if an enzyme-catalyzed reaction is to occur. (Section 27.3)

cohesive forces Attractive forces between like molecules. (Section 11.3)

coke An impure form of carbon formed when coal is heated strongly in the absence of air. (Section 22.6)

colligative properties Those properties of a solvent (vapor-pressure lowering, freezing-point lowering, boiling-point elevation, osmotic pressure) that depend on the total concentration of solute particles present. (Section 13.5)

colloidal dispersions (colloids) Mixtures containing particles larger than normal solutes but small enough to remain suspended in the dispersing medium. (Section 13.6)

combination reaction A chemical reaction in which two or more substances combine to form a single product. (Section 3.2)

combustion reaction A chemical reaction that proceeds with evolution of heat and usually also a flame; most combustion involves reaction with oxygen, as in the burning of a match. (Section 3.2)

common-ion effect The effect of an ion common to an equilibrium in shifting the equilibrium. For example, added Na_2SO_4 decreases the solubility of the slightly soluble salt BaSO_4 , or added $\text{NaC}_2\text{H}_3\text{O}_2$ decreases the percent ionization of $\text{HC}_2\text{H}_3\text{O}_2$. (Section 17.1)

complementary colors Colors that, when mixed in proper proportions, appear white or colorless. (Section 25.7)

complete ionic equation An equation written with all soluble strong electrolytes shown as they exist in aqueous solution, that is, as ions. (Section 4.4)

complex ion (complex) An assembly of a metal ion and the Lewis bases bonded to it. (Section 17.5; Chapter 25: Introduction)

composite A complex solid mixture of two or more components. One component is usually present in much greater quantity than the others and acts as the primary host matrix for the other components. (Section 12.3)

compound A substance composed of two or more elements united chemically in definite proportions. (Section 1.2)

concentration The quantity of solute present in a given quantity of solvent or solution. (Section 4.1)

condensation polymerization Polymerization in which molecules are joined together through condensation reactions. (Section 12.2)

condensation reaction A chemical reaction in which a small molecule such as a molecule of water is split out from between